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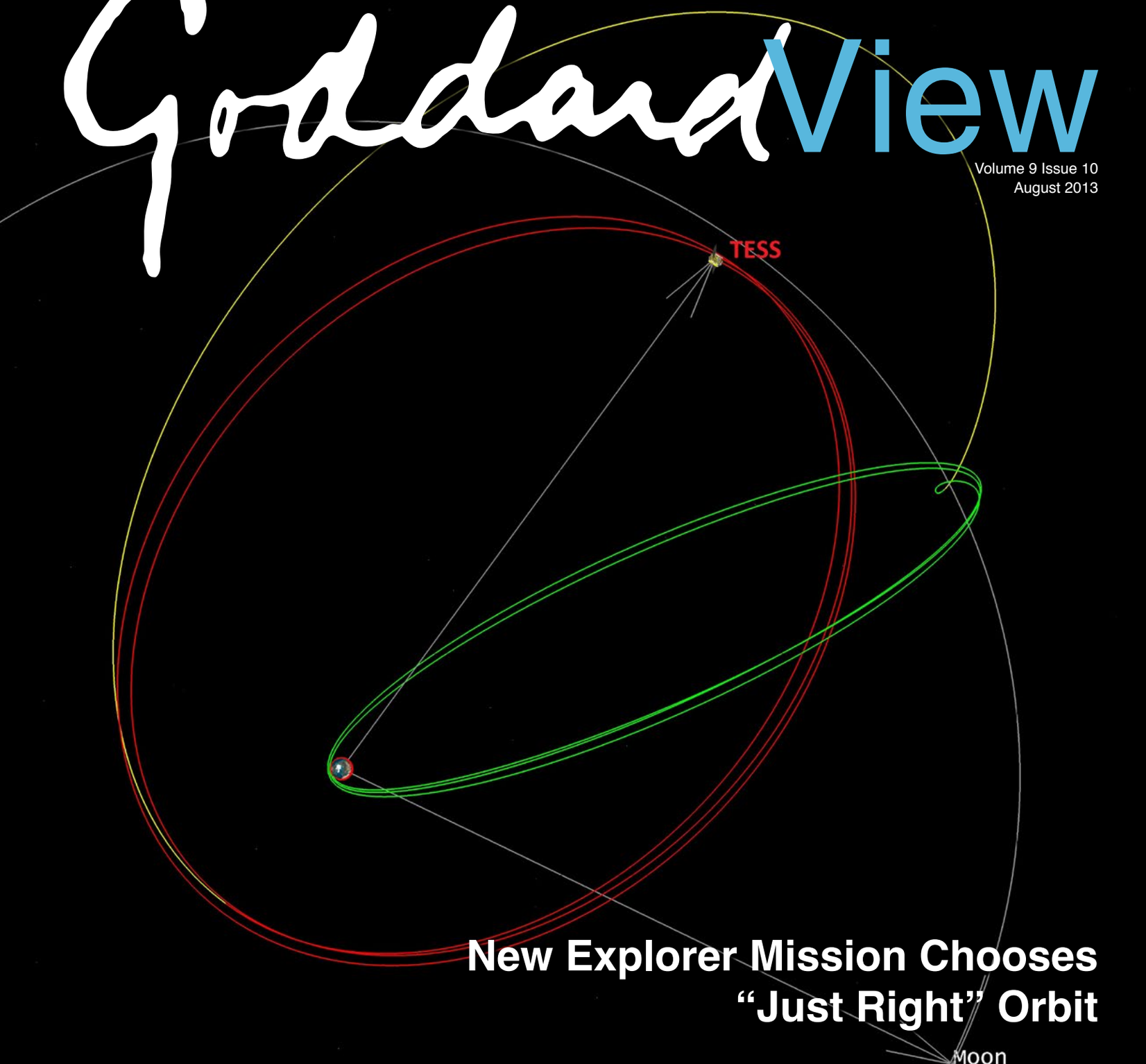

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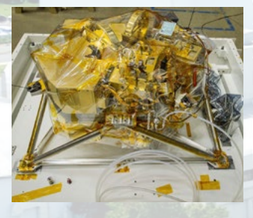

Webb Telescope's NIRCam
The optics module of the James Webb Space Telescope's primary imager, the Near-Infrared Camera, arrived at NASA's Goddard Space Flight Center in Greenbelt, Md., on Saturday, July 27, 2013. This photograph shows the NIRCam optics module in a Goddard clean room. For more, click on the image.

New Hardware for RRM
The Japanese HTV cargo vehicle will deliver a new task board and the RRM On-orbit Transfer Cage, an original device designed to transfer hardware outside of the space station. Click to explore RRM.

Seeing Which Way the Wind Blows
When the unmanned Global Hawk carries a radar system this summer, its cargo will be hard to see. The autonomous and compact High-altitude Imaging Wind and Rain Profiler will hang under the aircraft's belly as it flies above hurricanes to measure wind and rain and to test a new method for retrieving wind data. Learn more by clicking on the picture.

Life@Goddard
Click on the picture to explore the latest edition of Life@Goddard. This week's edition features a thank you and a hug, overthinking and the Aloha spirit. There's much more to discover at Life@Goddard.

On the cover: The Transiting Exoplanet Survey Satellite's trajectory from launch to final mission orbit. The green line represents the phasing loops before the lunar flyby. The yellow is the resulting trajectory from the flyby and the red shows the final mission orbit. Image credit: NASA

GoddardView

Goddard View is an official publication of NASA's Goddard Space Flight Center. Goddard View showcases people and achievements in the Goddard community that support Goddard's mission to explore, discover, and understand our dynamic universe. Goddard View is published weekly by the Office of Communications.

News items for publication in *Goddard View* must be received by noon Wednesday of each week. You may submit contributions to the editor via e-mail at john.m.putman@nasa.gov. Ideas for new stories are welcome but will be published as space allows. All submissions are subject to editing.

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GODDARD INTERNS SHARE THEIR WORK

By: Talya Lerner

In preparation for the Intern Poster Session (story on Page 10), a few interns at NASA's Goddard Space Flight Center had the opportunity to share what they learned and accomplished this summer in a low-stress, friendly environment.

Whether it was learning something new, gaining a new level of confidence or winning some trivia prizes, everyone at the Intern Open Mic event walked away with something.

"The Open Mic was used as a creative forum where interns can discover what other interns are doing this summer in an informal and fun way," said Shamara Thornton, one of the Office of Communications event organizers. "While doing this, they are able to practice oral communication skills, present research results in a visual form and develop discussion skills."

Jessica Avva, from the University of Chicago, spoke about the Fermi Gamma-ray Space Telescope. She said she wanted to present because "giving talks at conferences and colloquia is such a huge part of academia."

Paul Bourget, pursuing a degree at the University of Southern Maine, is currently in the middle of his second internship at Goddard. "When I was here last year I saw everyone doing their presentations and I felt like I missed out on something," he said. This year though, "I decided to jump on it and present," he said. Bourget presented on the North American Forest Dynamics Project. He described what he learned about remote sensing in geographic information systems. "I am passionate about what we are doing and I love this kind of work," he said.

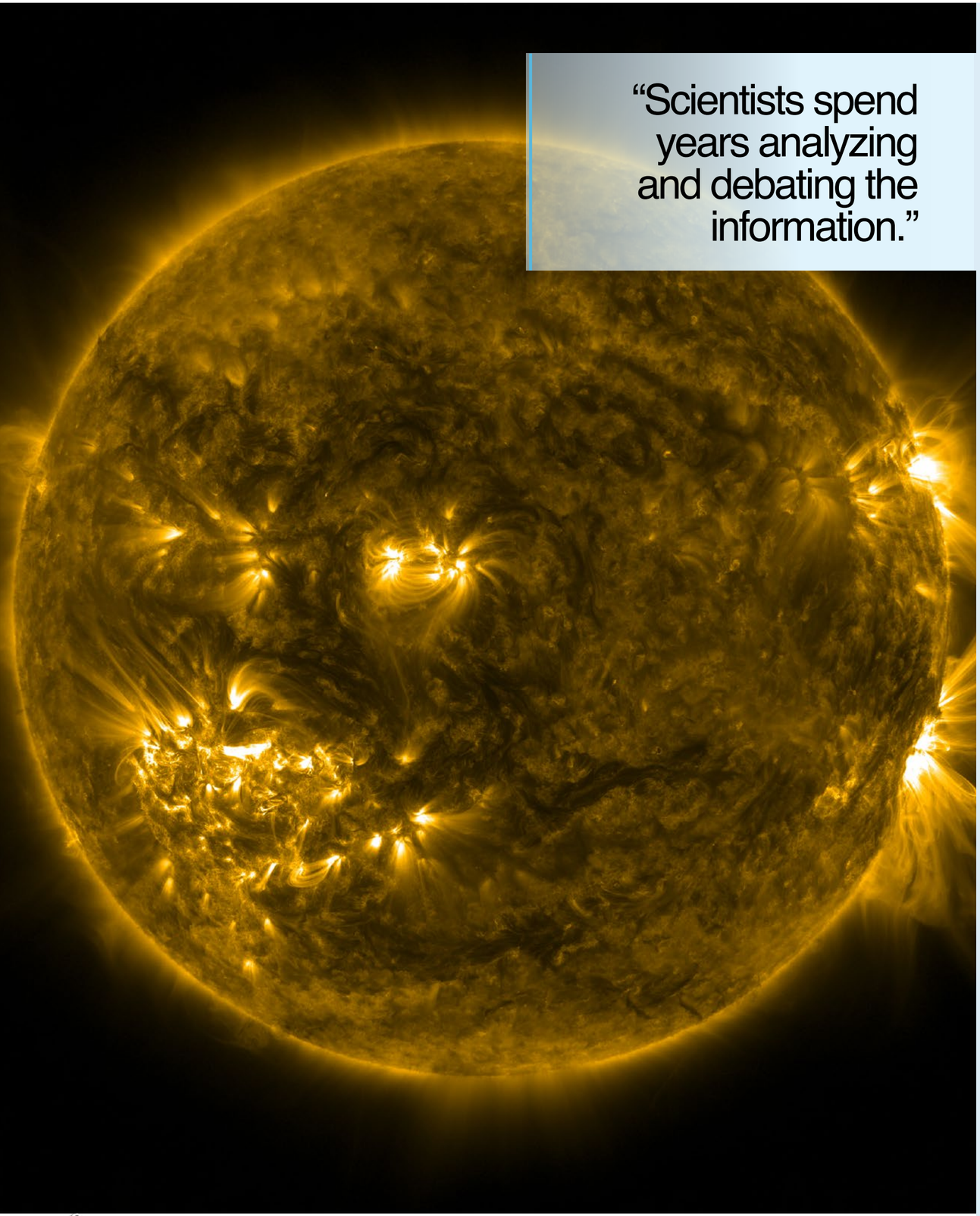
Rachel Elliot and Mikaela Johnson shared their experiences on hearing protection at NASA Goddard. "We thought we had a unique project," Johnson said. "Most people don't work in the health unit." They spoke about the Hearing Conservation Program at Goddard, a program for those affected by hazardous noise levels, and ways to prevent hearing loss on center.

Getting up and sharing your knowledge in front of a large audience is no easy task. "It was fun and a little bit nerve-wracking," Elliot said.

Anthony Cotto, who spoke about the new infrared camera he is working on, said,"When companies recognize that you can communicate you can excel, and I want to excel."

The interns presented in front of about 45 fellow interns, Goddard employees and mentors. "The best part was seeing the mentors come out and support their interns," Thornton said. ■

Above: From left: Interns Paul Bourget, Anthony Cotto, Rachel Elliott, Mikaela Johnson, Jessica Avva, Bonnie Powell, Caroline Juang and Dan Krieger, Diversity and Inclusion Program Manager, who served as the event's master of ceremonies. Photo credit: NASA/Goddard/Bill Hrybyk



“Scientists spend years analyzing and debating the information.”

SOUNDING ROCKET WILL STUDY ACTIVE REGIONS ON THE SUN

By: Karen C. Fox

At NASA’s White Sands Test Facility in Las Cruces, N.M., a sounding rocket is being readied for flight. Due to launch on Aug. 8, 2013, the VERIS rocket, short for Very high Resolution Imaging Spectrometer, will launch for a 15-minute trip carrying an instrument that can measure properties of the structures in the sun’s upper atmosphere down to 145 miles across, some eight times clearer than any similar telescope currently in space.

When it comes to observing the sun, different instruments and techniques must be used to study different temperatures of material or different layers of the sun from its surface out into its active upper atmosphere, the corona. VERIS will focus on the very hot material present in what’s known as active regions, magnetically complex spots in the corona that are often the location of eruptions on the sun such as solar flares and coronal mass ejections, which can send radiation and solar material toward Earth, potentially disrupting satellite systems and radio communications.

“On the sun, these large scale energy releases are driven by small scale physical processes,” said Clarence Korendyke, principal investigator for VERIS at the United States Naval Research Laboratory in Washington, D.C. “So we need to look at and understand the tiny details of those processes.”

After VERIS launches, it will begin to soar 150 miles up into space. When the rocket passes 60 miles, it will be above the bulk of hydrogen and water in Earth’s atmosphere that block solar emissions from reaching Earth, and the instruments will begin collecting useful scientific data. Engineers on the ground will point the telescope at a pre-selected active region on the sun and gather observations for some six minutes. During that time, the rocket will reach the peak of its trajectory and then fall back towards Earth to re-enter the atmosphere. At that point, a parachute deploys and the rocket floats back down to the ground—still within White Sands, but some 60 miles away from the launch site—where it will be retrieved by helicopter.

“Sounding rockets only gather five to six minutes worth of data,” said Angelos Vourlidas, project scientist for VERIS at the Naval Research Laboratory. “But then scientists spend years analyzing and debating the information.”

VERIS’s six-minute flight can yield such rich information partly because of the flexibility of instrument size possible on a sounding rocket. The mirror diameter is 17 inches while the entire telescope length spans almost 10 feet and weighs almost 1,000 pounds, making it much too large to fly on a satellite. VERIS’s telescope is unique because it is the first to gather a kind of data known as spectra of this region of the sun at such high resolution. Spectra provide information on how much of any given wavelength of light is present. The instrument works by passing the light from the telescope through a slit and onto a grating that separates the light into its constituent wavelengths, much the way a prism can. Each wavelength corresponds to a different temperature of material—a charged gas, called plasma—present on the sun. So looking at any given wavelength can give information about just one temperature of material at a time. The spectra can also be used to collect density and velocity information about the active region. Together, this information can help scientists distinguish between theories on what causes heat to well up from the lowest layers of the sun’s atmosphere to its highest, resulting in a corona that is a mysterious 10,000 times hotter than its surface.

“There are two categories of theories on how the corona is heated. One proposal is that small bursts of energy, called microflares, constantly erupt, heating the material. Another is that waves flow up from the surface to the corona,” said Vourlidas. “VERIS will be able to provide temperature information at the smallest level, and help distinguish between these theories.”

To support the VERIS observations, scientists will also turn to data sets gathered simultaneously by other solar observatories, such as the joint NASA-Japanese Aerospace Exploration Agency’s Hinode and NASA’s newly-launched Interface Region Imaging Spectrograph, which observes the lower, cooler layers of the sun’s atmosphere.

A success of a mission like this also serves as a significant test to see if a similar instrument should be part of the next generation of solar telescopes, which will continue to help unravel the complex behavior of our closest star.

“Understanding the sun does not, by itself, lead to the capability for us to predict when the sun will send a burst of radiation or particles toward Earth,” said Korendyke. “But at the end of the day, you can’t have such a capability without first having that understanding.”

VERIS was built at NRL with funding for the NASA Low Cost Access to Space program. It will launch aboard a Terrier-Black Brant IX rocket. The NASA sounding rocket program is managed for the agency at the Wallops Flight Facility in Virginia. ■

Opposite: The bright regions in this image of the sun correlate to what’s known as active regions in the solar atmosphere and they are areas that can spawn giant eruptions on the sun. The VERIS rocket, short for Very high Resolution Imaging Spectrometer, will study the physical properties of these regions in exquisite detail during a 15-minute flight in early August 2013. This image was captured by NASA’s Solar Dynamics Observatory in July 2012. Image credit: NASA/SDO

NEW EXPLORER MISSION CHOOSES "JUST RIGHT" ORBIT

By: Lori Keesey

Principal Investigator George Ricker likes to call it the "Goldilocks orbit"—it's not too close to Earth and her Moon, and it's not too far. In fact, it's just right.

As a result of this never-before-used orbit—advanced and fine-tuned by Goddard engineers and other members of the Transiting Exoplanet Survey Satellite team—the Explorer mission led by Ricker will be perfectly positioned to map the locations of more than 500 transiting exoplanets, extrasolar planets that periodically eclipse each one's host star. When the two-year mission begins in the 2017-2018 timeframe, it will represent the first time NASA has examined a large number of small planets around the brightest and closest stars in the sky.

TESS will use an array of wide-field cameras to perform the all-sky survey of a broad range of exoplanets, ranging from Earth-size to gas giants. From this survey data, the James Webb Space Telescope as well as large ground-based observatories will be able to further characterize the targets, making it possible for the first time to study the masses, sizes, densities, orbits, and atmospheres of a large cohort of small planets, including a sample of rocky worlds in the habitable zones of their host stars.

The Goddard-managed mission will "carry out the first spaceborne all-sky transit survey, covering 400 times as much sky as any previous mission," said TESS Principal Investigator Ricker, a senior research scientist at the Massachusetts Institute of Technology's (MIT) Kavli Institute for Astrophysics and Space Research. "It will identify thousands of new planets in the solar neighborhood, with a special focus on planets comparable in size to the Earth."

"This is a great mission and it stands on its own merits," added Tim Sauerwein, who managed the TESS proposal effort at Goddard. "I certainly don't attribute the win solely to the orbital analyses performed by our team, but I strongly believe they contributed. This orbit is absolutely ideal for this mission."

To carry out an exhaustive two-year survey of extrasolar planets in both celestial hemispheres, TESS needed to occupy a very particular position in space, a highly stable place that maximized sky coverage and gave the observatory a mostly unobstructed view of the cosmos, all from a low-radiation, thermally benign environment.

After exhaustive studies by Goddard engineers and contractors, the TESS team chose a never-before-used lunar-resonant orbit known as P/2 in the parlance of scientists. This high-Earth, highly elliptical orbit has a period half that of the Moon's orbital period, meaning that the satellite makes a complete orbital circuit every 13.7 days.

When the spacecraft is at the lowest point closest to Earth at 67,000 miles, it remains well above geosynchronous orbit 22,236 miles above the equator where most communications satellites operate. At this lowest point, TESS will orient its dish antenna to Earth and transmit data to ground stations below, a process that will take three hours. At its highest point, some 232,000 miles above Earth, it avoids the hazards posed by the Van Allen radiation belts.

"This is the first time this orbit has been used," said Trevor Williams, a Goddard engineer who played a pivotal role in evaluating the trajectory's appropriateness for the TESS mission. "It's a stable orbit, stable in the sense that it isn't plagued by attitude perturbations."

Although lunar-resonant orbits were first discussed in the early 1990s, TESS's particular trajectory was based on the original work of Goddard contractors Daniel McGiffin and Michael Matthews, both from the Computer Sciences Corporation in Lanham-Seabrook, Md., and Goddard engineer Steven Cooley. In 2001, the team published a paper describing their research into lunar-resonant orbits and explaining why they were ideal for a range of space missions.

Specifically, the paper reported that at lunar-resonant orbits, perturbations from the gravitational tug-and-pull exerted on spacecraft by the Moon and Earth are roughly zero, especially if the spacecraft's apogee is about 90 degrees with respect to the Moon. As a result, these orbits offer long-term stability for spacecraft. Once a satellite reaches the trajectory, few, if any, station-keeping maneuvers are required to keep it there.

After reviewing this and other papers, Ricker joined forces with the center's Navigation and Mission Design Branch in 2011-2012 to examine the details of the P/2 orbit and the precise maneuvers needed to deliver TESS to this "distinctive orbit."

The evaluation by the combined TESS team confirmed that the orbit offered a relatively clear view of the cosmos, good visibility of ground stations, little contamination from stray light, and a benign, low-radiation environment—all important ingredients for a productive all-sky survey cataloguing extrasolar planets around bright stars. Just as important, the team concluded that once TESS reached its P/2 orbit—through a series of maneuvers also involving a lunar flyby to gain momentum from the moon's gravity—it would remain stably in that orbit for several decades.

Further analysis funded by Goddard's Internal Research and Development program revealed that the orbit afforded a far greater number of actual launch days than originally envisioned. "One of the most significant things we accomplished, and Trevor (Williams) played a key role, was determining that, at its farthest point, the spacecraft-Earth-Moon angle doesn't need to be 90 degrees, but can vary as much as 30 degrees from that and still provide a stable orbit," said Chad Mendelsohn, a Goddard engineer involved in the orbit studies.

As a result, the mission will enjoy many more launch opportunities. In fact, in any given 27-day lunar cycle, the TESS team will be able to launch on 23 of those days. "We relaxed the orbit constraints and really opened up the launch window," Mendelsohn said.

Indeed, TESS will take advantage of a number of innovations, one of the most significant being its never-before-used orbit, Ricker said. "For TESS, we were able to devise a special new 'Goldilocks' orbit for the spacecraft, one which is not too close, and not too far from both the Earth and the Moon," Ricker said. ■

Above: Goddard engineers Chad Mendelsohn, Trevor Williams, and Don Dichmann helped formulate NASA's next Explorer mission's never-before-used orbit. Photo credit: NASA/Goddard/Pat Izzo

ONCE A MATHER SCHOLAR, ALWAYS A MATHER SCHOLAR

By: Crystal Garner

Eager students huddled at the entrance of NASA's Goddard Space Flight Center's Building 8 and introduced themselves to John Mather, the astrophysicist, cosmologist and physics Nobel Prize winner with a namesake scholarship, before departing on a day of celebration.

The 11 Goddard undergraduate and graduate student interns in the 2013 class of John Mather Nobel Scholarship recipients celebrated at an awards luncheon on July 26 at the Johns Hopkins Club in Baltimore, Md. They visited the Space Telescope Science Institute, also in Baltimore, the center that processes Hubble Space Telescope data.

Each year since its beginning in 2008, the program has provided allowances to scholars that cover the costs of travel incurred to present research papers at professional conferences. Mather also offers to write letters of recommendation for any award scholar. To be considered for the award, applicants must have high academic achievement and interest in space, while showing promise on Goddard-based assignments.

"[I'm] impressed with the warmth and energy and talent" of this year's scholars, Mather said. "I am so pleased that we have a way to extend the benefits of the Nobel Prize to the Goddard team through the scholarship awards to summer interns."

Jonathan Flugel, a senior computer information systems student at Bernard M. Baruch College in New York, said he is honored to be part of the occasion, and he embraces the experience as confirmation of his hard work.

"This award serves as tremendous validation that passion combined with a positive work ethic can yield the realization of a dream," Flugel said.

Jessica Avva, a senior physics student at the University of Chicago said she feels enthused by the experience.

"This award is more than just a title; it's a relationship with a brilliant scientist, an inspiration for my creativity and drive, and a standard to uphold," Avva said.

Mather Scholar and current aerospace engineer at Goddard, Allison Willingham, recalled traveling to a NASA technical conference in Pasadena, Calif., and the impact it had.

"I learned a lot about new state-of-the-art technologies used in satellites, she said. "It expanded my knowledge of what design of spacecraft looks like and encouraged me to continue interning at Goddard in the Components and Hardware branch. Two years later, I am working full time as a civil servant and loving my job!"

David Rosage, Goddard's administrator for Student On-Line Application for Recruiting interns, fellows and scholars, has worked with the program since its founding.

"It all got started after an informal discussion I had with Dr. Mather," Rosage said. "He advised that he would like to use some of his award money to give back to Goddard by identifying Goddard interns who would like to be part of Goddard's future." The rest is history.

To date, there have been 53 Mather Nobel Scholars. Keeping the awardees in mind, the journey doesn't end after college. "Once a John Mather Scholar, always a John Mather Scholar," the program's motto proudly states. ■

Above: John Mather Nobel Scholars gather with scholar alumni and Mather himself. Photo credit: David Rosage

A DAY IN THE LIFE OF A SCIENTIST AND EDUCATOR

By: Kasha Patel

Eric Brown de Colstoun proudly holds up a poster of an anime version of himself. "I even have hair," he said, pointing to the drawing and then touching his balding head. "I haven't had this much hair for a while."

The poster was a gift students gave him at a science, technology, engineering and mathematics fair at Patuxent Valley Middle School in Maryland. The back of the poster is covered with thank-you notes from the student artist and her classmates. Over the past school year, Brown de Colstoun, who works in the Earth Sciences Division at Goddard, worked with teachers and visited with the class and school, speaking to them on topics relating to Earth science, climate change and professions in STEM fields. Sometimes after he speaks to classes, students ask for his autograph. The poster, however, was a first in his 14 years of working with students.

"From an education perspective, I think we're really lucky at NASA," said Brown de Colstoun. "If I [say], 'Hey, I work with NASA, I'm here to talk to you,' right away, the kids are saying, 'Oh cool.'"

Once a month, he visits classrooms in Howard and Prince George's counties in Maryland, giving presentations about the STEM fields and coordinating hands-on projects to investigate climate change questions, such as how construction affects the environment. For one project, students separated and mapped their school area into about 15 feet grids, designed a new wing for the building, discussed the potential environmental impact and presented their findings to their principal.

"When you engage some kids, take them outside, open up that window and show that stuff you're learning in school actually gets used in the real world, I found that you get a lot more positive feedback," Brown de Colstoun said. "You feel like what you're doing makes a difference."

When he was a student, Brown de Colstoun did not anticipate he would work in the education field. After getting his undergraduate degree in mathematics, he worked as a ski instructor for five years in Colorado—the extent of his early exposure to teaching. While pursuing his master's and doctorate degrees in geography at the University of Maryland, he did not actively pursue teaching and instead chose to focus on research.

His attitude changed when he joined Goddard's Biospheric Sciences Laboratory and later the Earth Sciences Division, working in close coordination with the Landsat Project Science Office. As a 2003-2004 fellow in the New Investigator Program, in which recently graduated doctoral students do both scientific and educational outreach work at NASA, he worked with national parks to develop methods to monitor and map land cover changes using Landsat data. His team also brought in students to work with the maps through a program called Global Learning and Observation to Benefit the Environment that pairs students in elementary, middle and high school with scientists to gather and analyze research data.

"The idea is, not only do you hopefully get some good data back from the students, but you involve them in the science part, too," Brown de Colstoun said. "The GLOBE program is how I got involved in education."

Having juggled both the science and education components since he came to Goddard, he took on the title of education and public outreach coordinator in 2010. In this role, Brown de Colstoun is in charge of visiting and speaking to classes, bringing other scientists into schools, supporting public events and working with the media. One day a week, however, he continues his scientific research in the Earth Sciences Division.

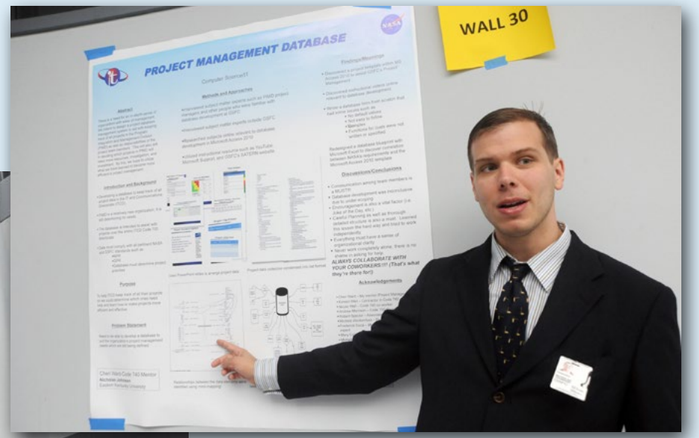
He studies images from Landsat satellites to estimate the extent of urbanization in the world—which has never been done globally at the detailed 100-foot scale the satellites provide. His project aims to identify and determine the cover of manmade structures like highways, parking lots and driveways and measure their change over the world from 2000 to 2010.

He currently works to involve students across the world in his urbanization research through the GLOBE program. The students will go outside in their community, measure different parts of their environment, such as land cover, and compare them to the scientists' estimations from the Landsat imagery.

"Many of my peers do not always realize the significant impact they can have on young people's perception of science, much in the same way they may have been motivated by someone to pursue science careers," said Brown de Colstoun. ■

Above: Eric Brown de Colstoun showing the poster he received rom students at a science, technology, engineering and mathematics fair at Patuxent Valley Middle School in Maryland. Photo credit: NASA/Goddard/Bill Hrybyk

GODDARD INTERN POSTER SESSION



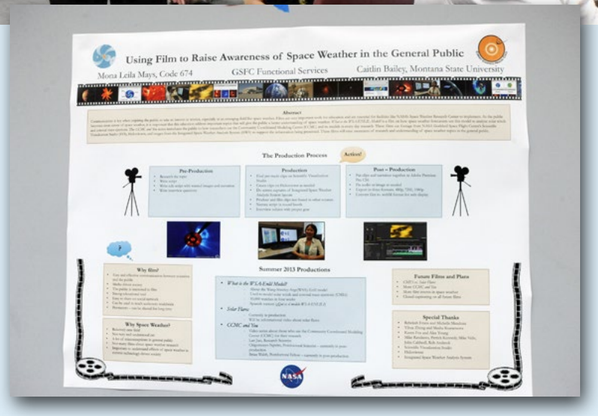
The NASA Goddard Office of Education hosted its Summer 2013 Intern Poster Session and Awards Program on August 2, 2013 in the Building 28 auditorium.

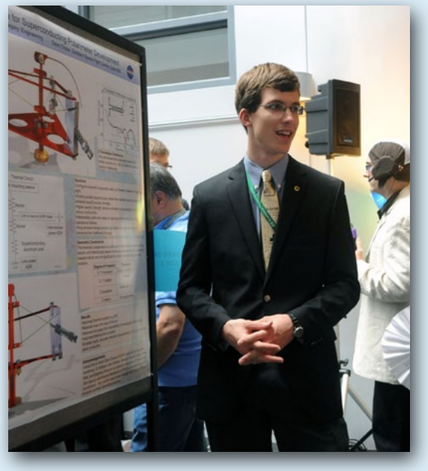
The Poster Session featured over 200 high school and college intern posters showcasing the interns work during this summer.

Awards were given out in the functional services, engineering and science categories.

Speakers included Robert Gabrys and Dean Kern from the Office of Education and Jim Garvin, Chief Scientist at Goddard. ■

Photo credit: NASA/Goddard/Debora McCallum





OUTSIDE GODDARD

By: Elizabeth M. Jarrell

A FAMILY TRADITION

Gamma ray astronomer Dr. Neil Gehrels' parents were very community service oriented. "My father, also an astronomer, helped dissident scientists from behind the Iron Curtain during the Soviet era and was active in education for poor children in India. My mother was a high school French teacher and a guiding light for hundreds of adolescents during their difficult years," said Gehrels. It is not surprising, then, that Gehrels and his wife and children are continuing the family tradition by serving the communities near Goddard.

From 1996–2004 when he left for college, Gehrels' son served on the Port Towns Youth Council. Established in 1997, the PTYC focuses on economically disadvantaged kids living in the port towns of Bladensburg, Colman Manor, Cottage City and Edmonston, Maryland. All of these towns are on the Anacostia River in Washington, D.C. and are part of the Anacostia Trails Area that ends in Laurel, Maryland near Goddard. "The PTYC is a wonderful, non-profit organization that tries to improve the lives of people, especially kids, in these port towns." said Gehrels.

Every month, Gehrels and his family performed community service for the PTYC. They planted trees, picked up trash, helped at a homeless shelter, brought food to homebound seniors, assisted at a wellness clinic where kids learned about healthy eating and exercising, and took groups of young people canoeing on the Anacostia.

"For some of these kids, it was the first time that they had ever been on the river, said Gehrels. "It opened their eyes to their environment, especially when they saw wildlife such as blue herons."

After his son left for college, Gehrels became a member of the Executive Committee for the PTYC on which he still serves. The group helped renovate and promote a local park known as River Front Park at Bladensburg Harbor.

"River Front Park is mostly for the neighborhood, but some of our Goddard physicists also go sculling there in the mornings," said Gehrels. "It used to be so neglected, but now it is a beautiful river park."

Gehrels also brought his community service spirit to Goddard. In 2005 after his son graduated, Gehrels helped develop a summer intern program for high school students from Port Towns to work at his labs at Goddard. "We try to find one or two promising kids, usually seniors, who have had some hurdles in their life, someone who could use some special attention," said Gehrels. The internships teach these kids test-taking strategies, laboratory skills and people skills.

"Their mentors at Goddard provide a daily role model of a successful person in science that they have never had before," said Gehrels. "We have had students in the program who are now in college studying engineering and science."

Gehrels is extremely happy that his interns stay in touch with him and each other though the PTYC, and that everyone returns for the annual graduation ceremonies that are akin to a family reunion. "It's really neat that my children get invited to the Council's annual graduation dinner. All these kids come back from college and attend with their parents. Everything is very parent-child oriented," said Gehrels.

Three generations of Gehrels have given back to their community through community service. "The example of my kids' grandparents and parents, and their own experience with the PTYC, has had a profound influence on my kids' lives. As a result, I believe they will always be community service oriented," said Gehrels. ■

Center: Gehrels serving breakfast with some other volunteers at So Others Might Eat in Washington, D.C. This particular meal served 400 people in need of food. Photo provided by Neil Gehrels